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INSTRUMENT FOR DRAINAGE OF THE CHEST
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3 Claims

ABSTRACT OF THE DISCLOSURE

One-way valve comprising tubular element of rubbery material surrounding a rigid nipple at one end to keep that end of element open. Nipple connectable to intrapleural catheter. Walls of remainder of valve flattened together to close passage between them, but yieldably separate to permit passage between them of air and masses draining from the chest. Valve is of appreciable length with respect to size of drainage masses. Nipple has smooth interior surface which diverges toward valve. Rigid chamber surrounds valve, and has outlet at end opposite nipple. Outlet may be spaced from opposite end of chamber to provide a water trap.

This application is a continuation-in-part of copending application No. 392,073, filed Aug. 18, 1964.

This invention relates generally to surgical apparatus, and has particular reference to an instrument for drainage of the chest.

In the treatment of certain chest injuries and illnesses, and often post-operatively, it is necessary to provide means for continuously draining air and fluids from the chest, i.e., from the region surrounding the lungs. The air pressure in the chest is normally slightly below atmospheric, and if there is any opening to it, either through the chest wall or through a puncture in the lung itself, air will enter and create an undesirable and dangerous condition.

It has been the practice, heretofore, to insert a drainage tube or catheter into the chest and to establish connection with relatively cumbersome drainage apparatus, including one or more bottles containing water and serving as traps, the rear end of the drainage tube being arranged in submerged position. To avoid any possibility of mishap due to reversal of flow or disturbance of the connections, it has been customary to locate the apparatus at or near the floor adjacent to or beneath the patient's bed. As a result, the patient is confined to bed, since the drainage procedure may not be interrupted. For similar reasons, administration of such drainage treatment under emergency conditions, e.g., to members of the military forces injured in battle, or during transportation of patients, has been quite difficult if not wholly impractical.

One of the objects of this invention is to provide a reliable means for continuously draining the chest of a patient in desired manner without confining the patient and without the necessity for employment of elaborate or directly-maintained apparatus. As a result, the patient can move around and be ambulatory, and can be treated under emergency conditions and transported without danger of lung collapse or other injury.

The attainment of this desirable result is predicated upon the employment of a novel instrument involving a one-way valve of structurally simple, readily portable character, light in weight, small in size, and thoroughly reliable and practical. The term "one-way valve" is intended to signify a valve adapted to allow passage of substances through it in one direction only.

One of the features of the invention resides in the circumstance that the valve unit may be readily fabricated,

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if desired, of inexpensive discardable material. Sterilizing and cleaning procedures may thus be avoided, and the use of the instrument expedited, although sterilization and re-use are not necessarily precluded.

Another feature of the invention lies in the design of the instrument in such a way that its use is not inconsistent with the employment of conventional apparatus. Accordingly, such apparatus may continue to be used, if desired, while the patient is in bed, and its use may be safely temporarily discontinued whenever the patient is up and around and is relying upon the portable instrument embodying the features of this invention.

A further feature of the invention relates to the design of the valve in such a way that it is responsive to minute differentials in air pressure. As a result, elaborate suction apparatus is not essential to a proper functioning of the instrument. Nevertheless the use of suction apparatus is not precluded, should it become necessary or desirable.

Valves of ordinary kind are not suitable for the present purpose because they do not close reliably when masses or particles of non-liquid material pass through. A valve is entirely useless, and its malfunctioning may be fatal to the patient, if it is susceptible to being wedged or jammed by a particle of matter into a setting in which it is not completely closed. To be useful for the special purpose of chest drainage, a valve must remain reliably closed at all times against influx of air into the chest cavity.

An important feature of the present invention resides in the employment of a specially configured valve having this capability. The valve is of the type which comprises a tubular element of rubbery material open at its inlet end but having its walls thereafter flattened together and yieldably urged by their inherent resilience into this condition to close the passage between them. The valve is so designed that the flattened part is of appreciable length whereby the passage through the valve is of considerable extent relative to the size of gobs or masses likely to pass through. The passage through the valve is thus defined by a substantial area of rubbery material which provides a sure closure against reverse flow and yet allows free forward passage of stuff through the valve by a resilient progressive separation and reclosing of the walls. Of primary significance is the fact that blood clots, tissue masses, particles, etc., are powerless to jam the valve into a dangerous open condition which would be fatal to the patient. Substances emanating from the chest work their way through the valve passage gradually, by a kind of peristaltic movement of the tube walls, i.e. the passage widens temporarily in advance of each mass of substance and closes itself automatically directly behind it as the mass moves toward the outlet. Even if a solid particle or gob were to become stuck, there is always a broad surface of the passage firmly and reliably closed against the undesired and perilous influx of air or liquid.

A still further feature of the invention resides in the provision of a special chamber, composed of rigid protective material, surrounding the valve and shielding it from external contact. The fluids and other substances passing through the valve are discharged into this chamber, and the chamber is provided with an outlet which allows optional connection of the instrument to a collection receptacle or to a suction tube. The chamber outlet may under certain circumstances be advantageously located above the level of a body of water within which the outlet end of the valve is immersed, so that the presence or absence or bubbling can serve as an indication of how the chest drainage is progressing.

One way of achieving these objectives and advantages, and such other advantages as may hereafter be pointed